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An example of a suitable surface covering includes a hot-melt calendered layer overlying a felt support layer and a foamable gel layer overlying the hot-melt calendered layer. A print 5 layer overlies the foamable gel layer, and a clear wear layer overlies the print layer. The waterborne coating is used to form a top coat layer that overlies the clear wear layer.

The present invention will be better understood with reference to the following non-limiting example.

10. **Example 1: Example of a waterborne composition**

In one embodiment, the epoxy dispersion is 0.01-30%, the polyurethane dispersion is 0.01-35%, the vinyl dispersion is 4%-60%, Nacure 2547 is 0.64%-2%, Nacure 1557 is 0.01%-2.9%, and a melamine crosslinker such as Resimene 745 is 3.5%-9.1% by weight of the composition. Resin solids level are 50%, 35% and 39%, respectively, for epoxy dispersion, polyurethane dispersion and vinyl dispersion resins. In another embodiment, the epoxy dispersion is 14-30% by weight, and the vinyl resin is 4-40% by weight of the composition. In another embodiment, the epoxy resin and polyurethane dispersion are each present in at least one percent by weight of the composition.

20. **Example 2: Flooring Structure Including the Waterborne Coating Composition**

A flooring structure including a 15 mils felt backing layer, a 20 mils PVC melt-calendered layer, a 10 mils foamable gel layer, a rotogravure printed pattern with inhibitor containing inks in specific locations, and a 15 mils gelled clear plastisol layer was prepared. A 25 top coat coposition including 306.00 gram Bayhydrol PR 435, 259.10 gram EPI-REZ Resin 3541-WY-50, 69.60 gram UCAR Waterborne Vinyl AW-875, 90.25 gram Resimene 745, 5.0 gram CoatOSil 1211, 17.90 gram Texanol, 3.90 gram Acrysol RM-825, 7.60 gram Nacure 2547, 9.40 gram Nacure 1557 and 231.25 D.I. water was prepared. The composition was applied to the plastisol layer by forward roll coater at an application rate that resulted in about 0.5 mils dry 30 coating thickness. The coated substrate was conveyed into a fusion and expansion oven heated at

190°C for two minutes. The final expanded and cured composition exhibited excellent chemical embossing and excellent top coat stain resistance.

The present invention is not restricted solely to the descriptions and illustrations provided
5 above, but encompasses all modifications envisioned by the following claims.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

embossed layer. The thickness of the coating layer is typically between 0.2 and 1 mils, although thicknesses outside of this range can be prepared.

Composition

5 The composition is an aqueous dispersion that includes three types of dispersed particles - polyurethane, polyvinyl chloride and epoxy resins. Any suitable particle size that can be stabilized in a dispersion can be used. In one embodiment, the composition also includes a melamine resin. In another embodiment, the composition includes one or more curing agents. When two or more curing agents are used, they can effect the cure at different temperatures or
10 different times at the same temperature.

Polyurethane Resin

Any suitable polyurethane resin can be used. In one embodiment, the polyurethane resins include reactive groups other than epoxy groups, such as hydroxy and/or thiol groups, that react with the epoxy groups in the presence of an acidic catalyst at elevated temperatures. In one embodiment, the epoxy resins have particle sizes are in the range of between 5 and 300 nm, and representative molecular weights in the range of 1,500 and 150,000. Examples of suitable polyurethanes include SpencerKellogg Products EA6010 (30% solids), and various Daotan polyurethanes (Solutia), Bayhydrol polyurethane dispersions (Bayer), such as Bayhydrol PR 435, 20 can also be used. Bayhydrol PR 435 is an aqueous aliphatic polyurethane dispersion that contains only 5% by weight of organic cosolvent, and includes about 35 wt. % solids.

Polyvinyl Chloride Resin

As used herein, polyvinyl chloride is intended to include homopolymers including only 25 vinyl chloride units, copolymers that include two homopolymers such as vinyl chloride and vinyl acetate, and compositions including such homopolymers and copolymers. Any suitable polyvinyl chloride resin can be used.

In one embodiment, the polyvinyl chloride resins include reactive groups other than 30 epoxy groups, such as hydroxy and/or thiol groups, that react with the epoxy groups in the presence of an acidic catalyst at elevated temperatures. In one embodiment, the resins are

hydroxy terminated resins. In one embodiment, the polyvinyl chloride resins have particle sizes are in the range of between 40 and 600 nm, and representative molecular weights in the range of 5,000 and 60,000. One example of a suitable resin is UCAR Waterborne Vinyl AW-845 (Union Carbide), which has an emulsion particle size of about 0.08 micron, a molecular weight of about 5 24,000, a glass transition temperature of about 80°C and a hydroxy (OH) equivalent weight of about 1005.

Epoxy Resins

Epoxy resins are well known to those of skill in the art. In one embodiment, the epoxy 10 resins include reactive groups other than epoxy groups, such as hydroxy and/or thiol groups, that react with the epoxy groups in the presence of an acidic catalyst at elevated temperatures. The epoxy resins may include more reactive groups, for example, more hydroxy groups, than epoxy groups. In one embodiment, the epoxy resins have particle sizes are in the range of between 300 and 1,000 nm, and representative molecular weights in the range of 400 and 8,000. An example 15 of a suitable epoxy resin is EPI-REZ Resin 3541-WY-50 (Resolution Performance Products). This resin includes approximately 5 hydroxy groups and 2 epoxy groups per molecule.

Melamine

Aminoplasts, of which melamines are an example, can be present in the compositions. 20 Melamines, also known as triaminotriazines, are well known to those of skill in the art. The melamines may or may not be partially or substantially methylolated, and the methylol groups may or may not be partially or substantially etherified with C₁₋₁₀ straight chain, branched or cyclic alkyl groups.

Many of these compounds are commercially available and sold, for example, as Cymel 25 crosslinking agents by the Cytec Industries, Inc., for example Cymel 301, and as Resimene resins by Solutia. Resimene 745 is an example of a suitable Resimene resin.

Curing Agents

The curing agents are typically acidic catalysts. They can be used to catalyze the curing 30 reaction between the melamine component, polyurethane resins that include reactive groups,

such as hydroxy-urethanes, the epoxy component, and polyvinyl chloride resins that include reactive groups, such as hydroxy-PVC resins. Examples of suitable catalysts include sulfonic acids, such as methane sulfonic acid, alkylated arylsulfonic acids such as p-toluenesulfonic acid, alkylated naphthylsulfonic acids such as dinonyl naphthalene sulfonic acid and dinonyl naphthalene 5 disulfonic acid. Other acids such as citric acid, maleic acid, phthalic acid and the like can also be used. The catalysts may be in the free acid form, or can be stabilized, for example, by using an amine to neutralize the acid, for example, an amine blocked dinonylnaphthalene sulfonic acid catalyst. The only restriction is that the catalysts are compatible with other components in the system. Such catalysts are well known to those of skill in the art and their selection is within the 10 capability of the ordinary artisan.

Nacure catalysts (King Industries) are examples of suitable catalysts. Specific examples include Nacure 2547 and Nacure 1557. Nacure 2547 is a faster curing catalyst and 1557 is a slower curing catalyst. Nacure 1557 (dinonylnaphthalene sulfonic acid type) requires about 40°C higher curing temperature than Nacure 2547 (p-toluene sulfonic acid type). In one embodiment, when two curing agents that promote curing at different temperatures are used, the curing 15 temperatures differ by at least about 25°C. When a combination of catalysts is used, the catalysts may each effect a cure at different temperatures, or at different times at the same temperature.

Surfactants

20 Surfactants can be added to impart additional stain resistance to the coated substrate. Examples of suitable surfactants include fluoroaliphatic and non-ionic surfactants. Combinations of surfactants can also be used. Examples of suitable surfactants include Fluorad surfactants such as Fluorad FC-340 and Fluorad FC-170-C (3-M Company) and Igepal-type surfactants. In one embodiment, a non- foaming commercially available surfactant is used, which has the 25 properties of both a surfactant and defoamer. CoatOSil1211 (Witco) is an example of a suitable non-foaming surfactant. It is a composition of trisiloxane alkoxylate, siloxane polyalkyleneoxide copolymer and polyalkylene oxide.

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